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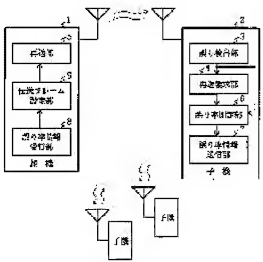
(54) RADIO LAN SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To actualize a radio LAN system which makes the required S/N small not decreasing the throughput.

SOLUTION: The bit error rate in use environment is measured and the number of continuous transmission frames (window size) is controlled according to the bit error rate.



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CLAIMS

[Claim(s)]

[Claim 1]A means to transmit a transmission frame of a continuous predetermined number.

A means to detect an error of data which was provided with a means to receive a transmission frame of this continuous predetermined number, and received this means to receive, by a transmission frame of said continuous predetermined number.

A means by which said means to transmit is equipped with a means to require resending of a transmission frame of said continuous predetermined number when an error is detected by said data according to a detection result of this means to detect, and said means to transmit resends a transmission frame of said continuous predetermined number according to this request sending.

It is the wireless LAN system provided with the above, a means to measure an error rate of data in communication between said means to transmit, and said means to receive was formed, and it had a means to set said predetermined number as variable according to a measurement result of this means to measure.

[Claim 2]The wireless LAN system according to claim 1 provided with a means to set frame length of a transmission frame as variable according to said measurement result.

[Claim 3]The wireless LAN system according to claim 1 or 2 containing a means by which a means to set said predetermined number and/or said frame length as

variable resets said predetermined number and/or said frame length periodically.

[Claim 4]The wireless LAN system according to any one of claims 1 to 3 with which said means to transmit, and said means to receive contain a means to perform frame transmission based on TCP (Transmission Control Protocol).

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention is used for the radio which performs error control with an automatic-request-for-repetition (ARQ:Automatic Repeat reQuest) method. This invention is suitable for using for wireless LAN.

[0002]

[Description of the Prior Art]As an error control system in a radio communications system, The forward direction error correction (FEC:Forward Error Correction) method which adds redundant information to information to foresee that an error happens and transmit originally at the transmitting side, and transmits to it, When an error arises, the automatic-request-for-repetition (ARQ:Automatic Repeat reQuest) method which aims at recovery from an error is well used by retransmitting once again.

[0003]A system is [in which a return channel becomes unnecessary as an advantage of FEC] easy, It is mentioned that it is effective in digital transmission of a sound with a severe stale demand, video, etc., and when the burst length of an burst error to whom many overhead bit length for error corrections being needed as a fault, and a decoder's becoming complicated and an error concentrate and happen is large, it is mentioned that correction becomes impossible.

[0004]In order to send the same information in a certain fixed time since the bit for error corrections is added to a sending-signal series as a redundant bit if an error

correcting code is used, it is necessary to send with a higher transmission rate, and a larger frequency band is needed. It is divided roughly into a block code and a convolutional code as an error correcting code.

[0005]In order to repeat request sending first as an advantage of ARQ until an error is no longer detected by a receiver, since only very reliable communication being possible and error detection are performed, compared with the case where overhead bit length performs an error correction, it is mentioned that the composition of a decoder is also comparatively easy few.

[0006]As a fault, since a return channel is needed, it is mentioned that delay becomes small and that request sending happens frequently by noise etc. when communication quality is inferior, and the information transmission efficiency per time, i.e., a throughput, falls. A resending protocol has a Stop-and-Wait type, a Go-Back-N type, and a Selective-Repeat type.

[0007]Since reliable communication being required and the second radio frequency are restricted in the first place as a feature of wireless LAN, Frequency utilization efficiency is high, and since it is used by that high transmission efficiency is required and semipermanent [third], it is mentioned rather than a random error like mobile communications that it is easy to produce an burst error by movement of people etc.

[0008]Reflecting the feature of such wireless LAN, there is much wireless LAN which has adopted only the ARQ system, and the Go-Back-N type is well used triggered by the simplicity of hardware as a resending protocol.

[0009]A Go-Back-N type resending protocol is a method which resends the data after the error frame according to the demand from a distant office, when two or more transmission frames are transmitted simultaneously and an error occurs. It is adopted as error control art of HDLC (High Level Data Link Control Protocol) used for the public wire circuit or IEEE802 standard.

[0010]By a receiver, when a transmission frame is received correctly, As an acknowledge signal, an ACK (Acknowledgement) signal, When an error is detected,

ACK of the transmission frame before the transmission frame which returned the NAK (Non Acknowledgement) signal to the transmitting side as a signal which requires resending, or the error generated is again returned to the transmitting side.

[0011]When an error is detected by a certain transmission frame, all the transmission frames after the transmission frame are also discarded. When an error occurs in the first transmission frame, it must stop for this reason, having to resend all of eight transmission frames in order once again also including seven transmission frames sent next, for example, when eight transmission frames are transmitted continuously. Therefore, when a bit error rate is large, it can be said that it is a method which influence tends to produce in transfer efficiency.

[0012]TCP (Transmission Control Protocol) which is a typical communications protocol which guarantees reliability is used for many applications on the Internet, such as FTP (File Transfer Protocol).

The important role is played also in the wireless LAN for which resending is needed to the frame error by interference and phasing peculiar to radio.

In TCP, the maximum continuation transmission quantity called window size is changed by the demand of a receiver. If NAK is not returned, window size the number of continuation transmission frames 1, 2, 3, 4, --, ** -- it increases like, and if NAK is returned, the number of continuation transmission frames will be changed again so that the following NAK or ACK of the transmission frame before the transmission frame which the error generated may be called 1, 2, 3, 4, and -- until a re-degree is returned.

[0013]

[Problem(s) to be Solved by the Invention]As explained above, since communication with high high speed and reliability is demanded, error control by an ARQ system is performed by wireless LAN. Now, in the 2.4GHz bandwidth medium-speed wireless LAN which has spread most, since an ISM (Industrial Scientific and Medical) belt with much spurious radiation noise is used, the request sending by noise etc. may break out frequently. the standard about the interconnection between the wireless LAN systems which use the same radio

frequency in 2.4GHz bandwidth medium-speed wireless LAN -- since it is not enough, electromagnetic compatibility may arise between different systems and request sending may increase. In all the wireless LAN, electromagnetic environment is complicated by improvement in the speed of digital equipment, and the rapid spread of wireless systems, request sending increases depending on an operating environment, and a possibility that transmission efficiency falls is becoming large. Since a frame error occurs by phasing and shadowing peculiar to radio other than these interference, a resending protocol has great influence on communication efficiency.

[0014]Originally, since TCP which is a communications protocol which guarantees reliability by error detection or resending control under such radio environment is the protocol designed being conscious of the wired network, it cannot say that it is not necessarily suitable for communication environment peculiar to radio.

[0015]For example, the transmission quality of the wireless LAN by which the transmission quality required of cable LAN is standardized by IEEE802.11 to a bit error rate being a 10^{-10} grade is a 10^{-4} grade. Also in the wireless LAN used by semipermanent, since the bit error which cannot be compared produces a cable by performing radio, this is because the demands to the transmission quality differ. Therefore, when building the wireless LAN which makes cable LAN a trunk-line data service network, the influence peculiar to wireless LAN of a bit error rate may arise from 10^{-10} to the bit error about 10^{-4}.

[0016]Drawing 8 is the result of measuring the standardization throughput (vertical axis) of the wireless LAN to the influence of noise and the relation of a S/N ratio (horizontal axis) to a certain communication environment, and is a figure showing the comparison a Selective-Repeat type case and in Go-Back-N type. In drawing 8, since it is measuring by connecting between wireless LAN with a coaxial cable, the influence of phasing etc. is not included. By IEEE802.11 which is one of the international standards of wireless LAN, since the transmission-frame length was 64K to 2048 K bytes, the case of the frame length of 64 K bytes and 2048 K bytes was shown.

[0017]From drawing 8, the difference of the Selective-Repeat type in 2048 K bytes and a Go-Back-N type is large in the S/N ratio [a throughput changes from 1/2 of the maximum to the maximum] of a between. When transmission-frame length is 64 K bytes, in the S/N ratio [a throughput changes from 0 to the maximum] of a between, it differs greatly. From these results, in the S/N ratio, in 15 dB to 25 dB, the difference of the throughput of a Selective-Repeat type and a Go-Back-N type is large, and it is shown that both characteristics differ greatly in a specific S/N ratio. That is, since transmission efficiency will fall indeed if a retry count increases, in the wireless LAN which uses the Go-Back-N type resending protocol, a protocol which lessens a retry count is desirable.

[0018]Drawing 9 is a figure showing the difference (vertical axis) of the throughput of a Selective-Repeat type and a Go-Back-N type to a bit error rate (horizontal axis). As shown in drawing 9, the characteristic changes with transmission-frame length, but in a bit error rate, both difference appears only in the range of $10^{-3}$from 10^{-7}. In the operating environment of actual wireless LAN, like the difference of the requirements of cable LAN and wireless LAN mentioned above, a bit error rate is the environment of $10^{-3}$from 10^{-7} in many cases, and the protocol which was conscious of the existing cable has become the cause of reducing transmission efficiency.

[0019]As mentioned above, in many networks with much traffic, memory management becomes complicated, and their restrictions on hardware are not [a Go-Back-N type] practical [since Selective-Repeat types differ and resend only the mistaken transmission frame, their transmission efficiency is good but]. If an error correcting code is used, a necessary S/N ratio will become small, but the frequency utilization efficiency which is the original purpose of wireless LAN is high, and the problem that a sacrifice fake colander is not obtained produces high transmission efficiency. When the transmitting side continues waiting for ACK to the transmission frame according to window size depending on window size, timeout will arise and the problem that the time which transmission takes increases will also be produced.

[0020]This invention was carried out to such a background and is ****. It is providing the target wireless LAN system small.

An object of this invention is to provide the wireless LAN system to which a throughput is not reduced.

[0021]

[Means for Solving the Problem]By measuring a bit error rate in environment used to achieve the above objects, and controlling the number of continuation transmission frames (window size) according to the bit error rate, this invention lessens a retry count and proposes a wireless LAN system which performs control to which transmission efficiency is not reduced.

[0022]An access point used as a bridge of a cable and radio usually exists in wireless LAN, and a using form which two or more terminals access is taken to the access point. In wireless LAN used by semipermanent, since change of a channel in an access point and each terminal is also semipermanent, measurement of a bit error rate over the channel can be performed easily.

[0023]A bit error rate transmits random signals, such as a maximum length shift register series (Maxmum-1 ength-Shift-register-sequence: M sequence), to an access point from the terminal side, An access point is measured by comparing with a random signal at the time of being transmitted correctly. An access point memorizes a bit error rate corresponding to ID (Identifier), IP (Internet Protocol), etc. of a terminal which transmitted, and notifies it to the terminal side. Also in environment by which a S/N ratio deteriorated, the terminal side makes delay by resending the minimum by controlling the number of transmission frames which transmit at once (window size) according to the bit error rate.

[0024]The optimal number of continuation transmission frames to a measured bit error rate changes with the bit length per frame. How to receive when transmitting a transmission frame of IEEE801.11 standard to Go-Back-N type wireless LAN which is a typical resending protocol of wireless LAN as an example is described below.

[0025]When transmission-frame length is made into N byte (8xN bit), relation between the frame error rate pf and the bit error rate Pb is $pf=1-(1-Pb)^{8N}$ (1). Since it becomes, a frame error rate can be predicted according to a measured bit error rate. The error rate pw around a window is $Pw=1-(1-Pb)^{8MN}$ (2), when it

carries out in the continuation transmission frame M [several].
Since it becomes 1/(1-Pf), a next door and an average retry count are M< 1/Pf(s) (3).
If it controls satisfied, continuation transmission to which resending is certainly carried out is avoidable. For this reason, reduction of window size by a frequent frame error can be prevented, and a resending frame number can be lessened.
[0026]Here, an example of 64, 128, 256 and 512 which are fundamental transmission-frame length, and the number of the maximum continuation transmission frames to each bit error rate at the time of 1024 or 2048 bytes is shown in Table 1.
[0027]
[Table 1]

フレーム長	10^{-4}以上	10^{-5}～10^{-4}	10^{-6}～10^{-5}	10^{-7}～10^{-6}
64 バイト	2	16	192	1920
128 バイト	1	8	96	960
256 バイト	1	4	48	480
512 バイト	1	2	24	240
1024 バイト	1	1	12	120
2048 バイト	1	1	6	60

Table 1 is set up satisfy a formula (3). It controls so that window size does not become extremely small, even if a frame error arises. For example, when transmission-frame length is [bit error rates] 10^{-6} - 10^{-7} in 2048 bytes, Make the six maximum transmission frames at the time of 10^{-6} - 10^{-5} into the minimum, and to the 60 maximum transmission frames in 10^{-6} - 10^{-7}, an extreme reduction of window size by generating of a frame error since 6, 12, 18, --, 60, and window size are changed -- evasion -- last ** Change of window size under environment of 10[in 2048]-6from transmission-frame length [of 64 bytes] and bit error rate 10-7 is shown in drawing 13 from drawing 10. Drawing 10 - drawing 13 take the number of times of transmission along a horizontal axis, and take window size along a vertical axis.
[0028]From drawing 10 - drawing 13, since large **** of window size changes in a unit suitable for communication environment as compared with the conventional

resending control, transmission efficiency of the resending method of this invention improves. It turns out that it is a figure showing the result of having compared the case of the standardization throughput characteristics at the time of using the resending control of this invention, and a Selective-Repeat type, a Selective-Repeat type and the near characteristic are obtained also from this figure, and transmission efficiency of drawing 14 is improving.

[0029]As explained above, transmission efficiency improves because it is a chisel which influence produces in a resending protocol in the range of a specific bit error rate and a transmission characteristic peculiar to radio controls window size to the transmission-frame length in this case. For example, under environment which resending certainly produces, by controlling window size by the unit adapted to communication environment, a resending frame number is decreased and transmission efficiency can be improved.

[0030]Namely, the wireless LAN system this invention is characterized by that comprises the following.

A means to transmit the transmission frame of the continuous predetermined number.

A means to detect the error of data which was provided with a means to receive the transmission frame of this continuous predetermined number, and received this means to receive, by the transmission frame of said continuous predetermined number.

A means by which said means to transmit is equipped with a means to require resending of the transmission frame of said continuous predetermined number when an error is detected by said data according to the detection result of this means to detect, and said means to transmit resends the transmission frame of said continuous predetermined number according to this request sending.

[0031]Here, a means to measure the error rate of the data in communication between said means to transmit, and said means to receive is formed, and the place by which it is characterized [of this invention] is one of the places provided

with a means to set said predetermined number as variable according to the measurement result of this means to measure. A predetermined number with high probability that resending will occur can be avoided by this, and a transmission frame can be transmitted.

[0032]It can also have composition provided with a means to set the frame length of a transmission frame as variable according to said measurement result. By the bit length per transmission frame, since the optimum value of said predetermined number changes, by setting frame length as variable, it can adjust now the optimum value of said predetermined number, and can raise the flexibility of said predetermined value setting out.

[0033]As for a means to set said predetermined number and/or said frame length as variable, it is desirable to have composition containing a means to reset said predetermined number and/or said frame length periodically.

[0034]As for said means to transmit, and said means to receive, it is desirable to have composition containing a means to perform frame transmission based on TCP.

[0035]

[Embodiment of the Invention]The composition of the wireless LAN system of this invention example is explained with reference to drawing 1. Drawing 1 is an important section block lineblock diagram of the main phone of this invention example, and a cordless handset. Actually, although the main phone and the cordless handset communicated bidirectionally, in order to explain plainly here, the one-sided signal transduction from a main phone to a cordless handset was assumed. In drawing 1, the graphic display was omitted about the blocks which are common knowledge and are directly unrelated to the feature of this invention, such as a transceiver block and a strange recovery block.

[0036]The wireless LAN system this invention is characterized by that comprises the following.

The main phone 1 which transmits the transmission frame of the continuous predetermined number.

The error detection part 3 which is a means to have the cordless handset 2 which

receives the transmission frame of this continuous predetermined number, and to detect the error of data which received this cordless handset 2 by the transmission frame of said continuous predetermined number.
When an error is detected by said data according to the detection result of this error detection part 3, the main phone 1 is equipped with the request sending part 4 which is a means to require resending of the transmission frame of said continuous predetermined number, The resending part 5 which is a means by which the main phone 1 resends the transmission frame of said continuous predetermined number according to this request sending.

[0037]The error rate test section 6 which is a means to measure the error rate of the data in communication between the main phone 1 and the cordless handset 2 is formed here the place by which it is characterized [of this invention], It is in the place provided with the error rate information transmission section 7, the error rate information reception part 8, and the transmission-frame set part 9 which are means to set said predetermined number as variable according to the measurement result of this error rate test section 6. The transmission-frame set part 9 can also set the frame length of a transmission frame as variable according to said measurement result. Said predetermined number and/or said frame length are reset periodically. The main phone 1 and the cordless handset 2 perform frame transmission based on TCP.
[0038](The first example) The first example of this invention is described with reference to drawing 2 and drawing 3. Drawing 2 is a figure showing the flow of the number setting out of transmission frames of the wireless LAN system of the first example of this invention. The wireless LAN of this invention realizes frame transmission adapted to communication environment (bit error rate), and since it is what raises transmission efficiency, as shown in drawing 2, it sets up a transmission frame between measurement of a bit error rate, and the main phone 1 and the cordless handset 2.
[0039]In Step 501, the cordless handset 2 requires transmission of the random

signal for measuring a bit error rate from the main phone 1. A random signal will be made to easy hard structure, such as a shift register, if an M sequence etc. are used. In Step 502, the main phone 1 transmits a random signal according to the demand of the cordless handset 2. In Step 503, the error detection part 3 of the cordless handset 2 measures the error rate of the random signal which the main phone 1 transmitted, and reports it to the main phone 1. Error detection is performed when the cordless handset 2 owns and compares the same random signal generator as the main phone 1 with measurement of an error rate. In Step 504, the cordless handset 2 saves the number of transmission frames the minimum to a bit error rate, and maximum. In Step 505, the main phone 1 saves ID and the bit error rate of the cordless handset 2, and the transmission-frame set part 9 sets the minimum number of transmission frames (window size) to the maximum to the cordless handset 2.

[0040]The deciding method of the maximum of the number of continuation transmission frames and the minimum is explained below. For example, when transmission-frame length is made into N byte (8xN bit), the relation between the frame error rate Pf and the bit error rate Pb is $Pf=1-(1-Pb)^{8N}$ (1), as mentioned above.

Since it becomes, a frame error rate can be predicted according to the measured bit error rate. When the number of continuation transmission frames is set to M (positive number), that to which resending is certainly performed (a frame error certainly arises) is MxPf>=1 (4).

Since it is a ** case, the number Mmax of the maximum continuation transmission frames (positive number) is Mmax<1/Pf (5).

It becomes. Here, when the number of the minimum continuation transmission frames is set to Mmin (positive number), it is Mmin>=1-/(LPf) (6).

It comes out, and it is and it is thought appropriate to usually set up about by L= 2 to ten. It is L=Pfmax/Pf (7) when the maximum of the frame error rate in measurement of the some times past is set to Pfmax, since dispersion in the frame error rate in each communication environment can also determine L.

It becomes. This will be because the method of fluctuating the about 1/10 number of continuation transmission frames of the number of the maximum continuation transmission frames to the number Mmax of the maximum continuation transmission frames by setting the number of the minimum continuation transmission frames to Mmin is suitable, if Pf varies about 10 times. Table 1 is a table showing the example of the preset value of the number of transmission frames.

[0041]Above, although explained supposing the signal transduction from the main phone 1 to the cordless handset 2, communication is performed using the transmission frame of the frame length by which the cordless handset 2 also set up the own transmission frame, and was set up actually after that. What is necessary is just to enable it to set up the cycle which performs such setting out, when the communication environment in radio changes in many cases.

[0042]The wireless LAN system and frame length of this invention are a figure showing comparison of the throughput characteristics of a fixed wireless LAN system, and drawing 3 takes a S/N ratio along a horizontal axis, and takes a standardization throughput along a vertical axis. This is the result of connecting between wireless LAN by a cable, and adding and measuring noise. As shown in drawing 3, in order to perform frame transmission with the window size based on communication environment by performing the above-mentioned setting out in the wireless LAN system of this invention, it turns out that transmission efficiency is improved to noise.

[0043](The second example) In the communication which performs frame transmission, the optimal transmission-frame length and window size are changed according to a bit error rate. In the second example of this invention, by controlling transmission-frame length to the bit error rate in communication environment describes how to improve a transmission characteristic.

[0044]the throughput S in Go-back-N (bit/sec) -- S={K-v-(1-Pf) -8.N/v}/{(1-Pf) -8.N/v+Pf-M, 8, and(N/v+C) +C} (8)

It is come out and expressed. K is a coding rate, Pf is a frame error rate here, v is access speed, M is a maximum frame number resent according to the demand from

a receiver, and C is processing time other than a transmission time.

[0045]Drawing 4 is a figure showing the result in which transmission-frame length calculated the throughput characteristics over each bit error rate in 256 to 4096 bytes using a formula (8) at the time of K= 1, v=2 Mbit/sec, M= 1, and C=0msec. Drawing 4 shows changing the optimal transmission-frame length to a bit error rate. In the case of this condition, in BER=10^{-4}, 256 bytes will be most suitable, and, as for 512 bytes and BER=10^{-6}, in BER=10^{-5}, 2048 bytes and BER<10^{-7} will be 4096 bytes. Thus, in the second example of this invention, a bit error rate is measured, and since a transmission frame is changed according to the bit error rate, transmission efficiency improves.

[0046](The third example) As for radio networked **, in the present wireless LAN, the protocol of TCP/IP is used in many cases. However, since TCP is the protocol originally designed being conscious of the wired network, it cannot necessarily say it as a protocol suitable for wireless LAN. So, in the third example of this invention, the case where the wireless LAN system of this invention is connected to cable LAN which used the protocol of TCP/IP is proposed.

[0047]Usually, wireless LAN has a main phone which has cable LAN and a bridge function, and in the main phone, in order to make congestion into the minimum, the buffer of 10 times or more is carried to the cordless handset. For this reason, in a main phone, the transmission frame sent from the cable side is temporarily put into a buffer, and it can perform controlling a transmission frame easily. In this invention, frame transmission adapted to radio environment is performed by accumulating the transmission frame currently controlled by the cable side by TCP in the buffer of a main phone, and transmitting with the window size set up by the flow of drawing 2.

[0048]Drawing 5 and drawing 6 are the figures showing the result in which the bit error rate observed change of the window size of TCP/IP of 10^{-5}, take the number of times of transmission along a horizontal axis, and take window size along a vertical axis. Drawing 5 is the conventional observation and drawing 6 is the observation of this invention. In the usual radio, if a bit error rate is 10^{-5}, it cannot be said as the large communication environment of a bit error rate. However, since wireless LAN

makes cable LAN a backbone, window size changes like cable LAN whose bit error rate is below 10^{-10}. Since window size changes like [in the conventional TCP] cable LAN as shown in drawing 5, When window size becomes a size unsuitable for the environment of bit error rate 10^{-5}, it turns out that window size contracts by a frame error, or transmission efficiency is falling by resending. On the other hand, when the wireless LAN system of this invention is used, window size is restricted under the same environment according to a bit error rate. Therefore, as shown in drawing 6, there is much number of times transmitted with the restricted maximum window size, and since the success frame number per number of times of the same transmission increases as compared with drawing 5, transmission efficiency is improved.

[0049]Drawing 7 is a figure showing comparison of the throughput characteristics of the wireless LAN system of this invention, and the wireless LAN system by the conventional TCP, takes a S/N ratio along a horizontal axis, and takes a standardization throughput along a vertical axis. It is the result of measuring using the same system of measurement as drawing 8 and drawing 3. As shown in drawing 7, in the wireless LAN system of this invention, it turns out that the characteristic to a S/N ratio is also improved to the wireless LAN which is performing resending control by TCP.

[0050]In the radio which there is almost no use under movement and is used by semipermanent like wireless LAN as explained above, It is easy to measure the bit error rate between a main phone and a cordless handset beforehand, and since transmission efficiency improves by changing window size and transmission-frame length according to the error rate, this invention is effective.

[0051]

[Effect of the Invention]As explained above, according to this invention, while being able to make a necessary S/N ratio small, the wireless LAN system to which a throughput is not reduced is realizable. That is, in wireless LAN, since more nearly high-speed communication is desired, it is set up enlarge size of the information transmitted continuously as much as possible. In the conventional communication

control system, since change of the information size in the communication environment which produces an error at a certain specific rate which transmits continuously was large, there was a problem in that delay by resending becomes large. Then, since this invention fluctuates the optimal continuation frame number according to an error rate, it can raise the performance of wireless LAN in respect of shortening of the time delay by resending.

EFFECT OF THE INVENTION

[Effect of the Invention]As explained above, according to this invention, while being able to make a necessary S/N ratio small, the wireless LAN system to which a throughput is not reduced is realizable. That is, in wireless LAN, since more nearly high-speed communication is desired, it is set up enlarge size of the information transmitted continuously as much as possible. In the conventional communication control system, since change of the information size in the communication environment which produces an error at a certain specific rate which transmits continuously was large, there was a problem in that delay by resending becomes large. Then, since this invention fluctuates the optimal continuation frame number according to an error rate, it can raise the performance of wireless LAN in respect of shortening of the time delay by resending.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The important section block lineblock diagram of the main phone of this invention example, and a cordless handset.

[Drawing 2]The figure showing the flow of the number setting out of transmission frames of the wireless LAN system of the first example of this invention.

[Drawing 3]The figure in which the wireless LAN system and frame length of this invention show comparison of the throughput characteristics of a fixed wireless LAN system.

[Drawing 4]The figure in which transmission-frame length shows the result of having calculated the throughput characteristics over each bit error rate in 256 to 4096 bytes.

[Drawing 5]The figure showing the result in which the conventional bit error rate observed change of the window size of TCP/IP of 10^{-5}.

[Drawing 6]The figure showing the result in which the bit error rate of this invention observed change of the window size of TCP/IP of 10^{-5}.

[Drawing 7]The figure showing comparison of the throughput characteristics of the wireless LAN system of this invention, and the wireless LAN system by the conventional TCP.

[Drawing 8]The figure in which being the result of measuring the standardization throughput (vertical axis) of the wireless LAN to the influence of noise and the relation of a S/N ratio (horizontal axis) to a certain communication environment, and showing the comparison a Selective-Repeat type case and in Go-Back-N type.

[Drawing 9]The figure showing the difference (vertical axis) of the throughput of a Selective-Repeat type and a Go-Back-N type to a bit error rate (horizontal axis).

[Drawing 10]The figure showing change of the window size under the environment of 10[in 2048]-6from transmission-frame length [of 64 bytes], and bit error rate 10-7 .

[Drawing 11]The figure showing change of the window size under the environment of 10[in 2048]-6from transmission-frame length [of 64 bytes], and bit error rate 10-7 .

[Drawing 12]The figure showing change of the window size under the environment of 10[in 2048]-6from transmission-frame length [of 64 bytes], and bit error rate 10-7 .

[Drawing 13]The figure showing change of the window size under the environment of 10[in 2048]-6from transmission-frame length [of 64 bytes], and bit error rate 10-7 .

[Drawing 14]The figure showing the result of having compared the case of the standardization throughput characteristics at the time of using the resending control of this invention, and a Selective-Repeat type.

[Description of Notations]

1 Main phone

2 Cordless handset

3 Error detection part

4 Request sending part

5 Resending part

6 Error rate test section

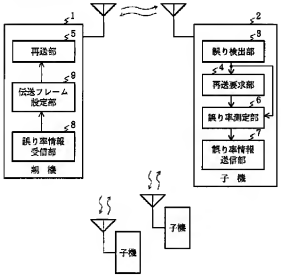
7 Error rate information transmission section

8 Error rate information reception part

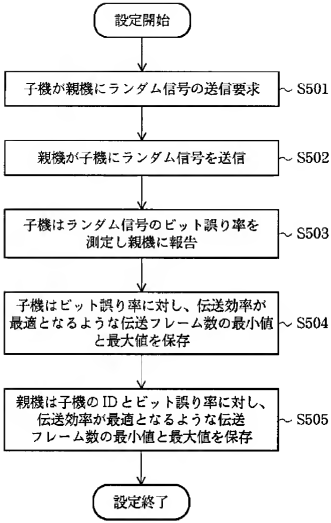
9 Transmission-frame set part

DRAWINGS

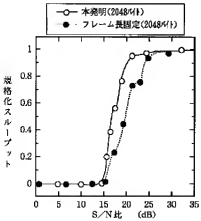
[Drawing 1]



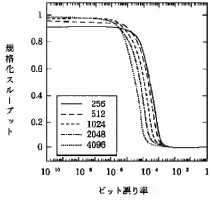
[Drawing 2]



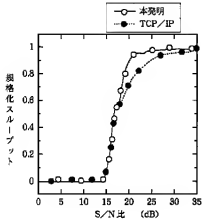
[Drawing 3]



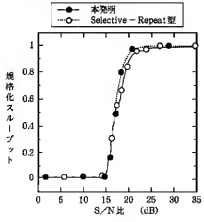
[Drawing 4]



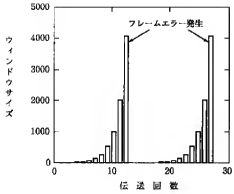
[Drawing 7]



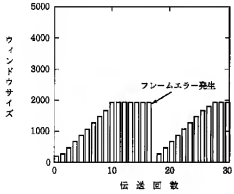
[Drawing 14]



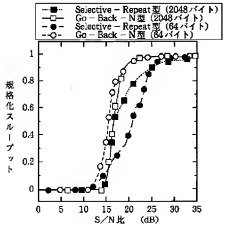
[Drawing 5]



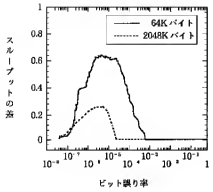
[Drawing 6]



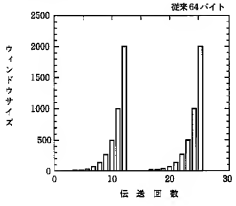
[Drawing 8]



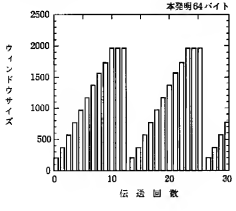
[Drawing 9]



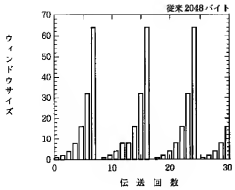
[Drawing 10]



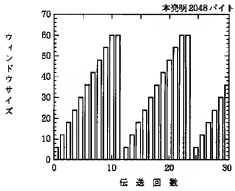
[Drawing 11]



[Drawing 12]



[Drawing 13]



CORRECTION OR AMENDMENT

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13/00 307 Z

[Written amendment]

[Filing date]October 15, Heisei 13 (2001.10.15)

[Amendment 1]

[Document to be Amended]Specification

[Item(s) to be Amended]Claim 2

[Method of Amendment]Change

[Proposed Amendment]

[Claim 2]Have a means to transmit a transmission frame of a continuous predetermined number, and a means to receive this continuous transmission frame of a predetermined number, and this means to receive, A means to detect an error of data which received by a transmission frame of said continuous predetermined number, When an error is detected by said data according to a detection result of this means to detect, said means to transmit is equipped with a means to require resending of a transmission frame of said continuous predetermined number, In a wireless LAN system provided with a means by which said means to transmit resends a transmission frame of said continuous predetermined number according to this request sending,

A means to measure an error rate of data in communication between said means to transmit, and said means to receive is formed,

A wireless LAN system provided with a means to set frame length of a transmission frame as variable according to a measurement result of this means to measure.